BIOLOGY 4751 - NEUROBIOLOGY I
2024 Serial

1. Instructor. Dr. Robert J. Omeljaniuk, CB-4013, 343-8010 (ext. 8236).
Office hours by appointment.

2. Intent. To provide senior undergraduate students with an opportunity to study selected aspects of neurobiology in a directed study approach.

3. Marking Scheme.
Submitted assignments. 9 X 10 marks = 90 final marks, normalized to 100 final marks.

4. Execution.

a. General.

(1) Students will be assigned specific readings from the course textbook and will be prepared to discuss the subject matter and any difficulties they may have with it in group discussions on a weekly basis. ***In the event that coordination meetings cannot take place, students should field their questions to the instructor either in person (if permitted), or by telephone or e-mail.***

(2) (a) Students' comprehension and mastery of the material will be evaluated on the basis of assignments submitted no later than one week following discussion of the subject matter.

(b) Answers to assigned questions may take any neatly presented word-processed format and text, figures and tables submitted as a hard copy; paragraph and short-essay answers supported by diagrams of the student's own design will be most appropriate.

(c) All figures and tables submitted will be prepared in the students' own hand; no photocopies or scanned/printed images are permitted. Textbook figure and table captions may be word-processed and included collectively in a separate section following figures and tables presented and are not included in the page limits.

(d) Absolutely NO electronic assistance of any kind is authorized in the preparation of figures and tables. Any indication of any electronic assistance used in this regard will result in the return of the entire assignment with a mark of zero, with no provision for resubmission.

(e) Page limits refer to narrative and not to figures or tables; assignment answers exceeding page limits will not be marked. In many cases, the preparation of an answer will require sourcing information from several sections of the textbook.

(3) (a) All assignments must be credibly completed.

(b) Class attendance is mandatory.

(c) If group gatherings are not permitted, then students must check-in with the instructor by sending an e-mail message confirming their continued participation in the course.

(d) As this course is assignment based, there is no provision for any supplementary or Special Exams.

(e) Assignments are due no later than 1200 hrs on the Friday of the week identified in the Tentative Outline below and are to be submitted into the appropriate assignment box on the third floor of the Biology area of the Centennial Building in the vicinity of CB3013 (an undergraduate laboratory).

(f) All submissions must be in hard-copy format.

b. Tentative Outline.

Serial	Chapter #	Chapter Title	Discussion Date (week of)	Assignment Deadline (week of)
1	01	The brain and behavior.	02 Sep	09 Sep
2	45	Patterning the nervous system.	09 Sep	16 Sep
3	45	Patterning the nervous system.	16 Sep	23 Sep
4	46	Differentiation and survival of nerve cells.	23 Sep	30 Sep
5	46	Differentiation and survival of nerve cells.	30 Sep	07 Oct
6	47	Growth and guidance of axons.	07 Oct Study Week No Meeting	21 Oct
7	48	Formation and elimination of synapses.	21 Oct	28 Oct
NIL	49	Experience and the refinement of synaptic connections	Read Only	Read Only
8	50	Repairing the damaged brain.	04 Nov	11 Nov
9	51	Sexual differentiation of the nervous system.	11 Nov	18 Nov

5. Textbook.

Principles of Neural Science (6th ed). E.R. Kandel, J.D. Koester, S.H. Mack, and S.A. Siegelbaum. McGraw-Hill. New York. 1646 pp. 2021.

Assignment 1.

See: a. The brain has distinct functional regions,
b. Box 1-1. Neuroanatomical terms of navigation, and
c. Box 1-2. Anatomical organization of the central nervous system.

1. Describe the orientation, structures and associated functions of brain regions. (4 p. limit, 10 marks).

Assignment 2.

1. Describe the origin and formation of the neural tube. (1 p. limit; 2 final marks).

2. Describe and discuss the factors associated with the origin of neurons. (2 p. limit, 2 marks).

3. Describe the factors and processes associated with the organogenesis and rostro-caudal differentiation of the neural tube. (3 pp., 3 marks).

4. Describe the factors and processes associated with the dorso-ventral differentiation of the neural tube. (3pp., 3 marks).

Assignment 3.

1. Discuss the factors associated with the diversification of neurons into multiple subclasses. (3pp., 4 marks).

2. Discuss the factors and morphogenetic movements associated with the development of the forebrain. (3pp., 6 marks).

Assignment 4.

1. Comment on the implications of symmetric and asymmetric division of neural progenitor cells, and the relevance of radial glial cells. (1 p., 2 marks).

2. Describe and discuss the factors associated with the generation of neurons and glial cells. (2 pp., 2 marks).

3. Discuss the factors and movements associated with neuronal migration. (3 pp., 4 marks).

4. Consider the growth and layering of the cerebral cortex. (1p., 2 marks).

Assignment 5.

1. Describe and discuss the origins of neuronal neurotransmitter phenotype. (1 p., 3 marks).

2. Discuss the factors associated with neuronal survival. (4 pp., 7 marks).

Assignment 6.

1. Discuss the differences in the early development of axons and dendrites, and, factors contributing to dendrite patterning. (2 pp., 2 marks).

2. Discuss the factors and processes associated with neuronal growth cone structure and movement. (2 pp., 3 marks).
3. Describe and discuss guidance mechanisms of axons; ganglion cell projection is an ideal model for consideration. (3 pp., 5 marks).

Assignment 7.

1. Using various models, describe and discuss the factors and mechanisms of neuronal recognition of specific synaptic targets. (4 pp., 6 marks).

2. Compare the development of central synapses and neuromuscular junctions and comment on post-natal synapse management. (4 pp., 4 marks).

3. Read: Glial cells regulate both formation and elimination of synapses.

Assignment 8.

1. Consider the implications of axonal damage. (2 pp., 2 marks).

2. Discuss potential outcomes and cellular/biochemical mechanisms associated with therapeutic interventions of injured central neurons. (6 pp., 8 marks).

Assignment 9.

1. Read: Genes and hormones determine physical differences between males and females.

2. Consider the relationships between sexual differentiation of the nervous system and sexually dimorphic behaviors. (2 pp., 3 marks).

3. Discuss the roles that environmental cues may have in initiating sexually dimorphic behaviors. (3 pp., 4 marks).

4. Describe and consider the implications of human brain sexual dimorphisms. (3 pp., 3 marks).